Recent Advances in Monitoring Science and Index Development
Friday, October 8, 2004

Issues:

What is the status of each research program?
What are the strengths?
Which areas need further development?
What are the prospects for implementation?

Presentations:

Current Results from the Great Lakes Coastal Wetlands Consortium
Ric Lawson, Great Lakes Commission, Great Lakes Coastal Wetland Consortium
Purpose of consortium–develop a long term monitoring program.
Inventory, implementation team, database.
Three phased project:

- indicator evaluation and development
- monitoring program
- coordination and implementation

Research management team, coordination by GLC.
GLNPO EPA funded.

RFP to test applicability of metrics and protocols: cost, measurability, basinwide applicability–IBI approach.

Phases 1 and 2 just about complete.

Inventory and classification–agreed upon standard hydrogeomorphic classification scheme with 10 HGM types.
Compiled existing inventories.
Seamless binational database.
Area baseline.

Need to assess practical means to improve inventory and measure changes.

Contracted to look at Landsat data and combine with Radar technology.
To help in identifying dominant plant species for help in classification and long term biometrics.
Able to pinpoint some of the dominant species.
Important to begin to determine quality of wetlands.
Seems to be helpful at deriving a boundary and identifying gross scale areas of invasive species.
And change in wetland type and inundation maps, perhaps loss of wetlands.

Contaminants bio-indicator.
Goal to validate snapping turtle as a bio-indicator. Sedentary, small home range, high trophic

position all reasons for choosing turtle.
May use to determine temporal trends within a given site.

Plant IBI objectives–relationship of land use and chemical impacts at sampling sites to indicate disturbance.
Transect methodologies.
Site based FQI and Conservatism indices seem to work best.
Problem with changing water levels.

Fish and invertebrates. Across lake, ecoregion, wetland and vegetation types.
Physical indicators, biological. Landscape measures as a surrogate.
Relationship across plant zones strongest.
Across different plant zones different invert and fish differences in response to degradation.

Marsh Monitoring Program protocols for birds.
High and low water level investigations.

Challenges for IBI metrics:
Finalize IBIs and assess across different criteria.
Plan to see how applicable in the field across wetland types.
Dedicated source of funding needed.
Coordinate and integrate data collection.

Questions:
collected data from a variety of wetlands that included a range of disturbance. Range determined by physical factors–buffers, chemistry (chloride surrogate for pollution), etc. to establish gradiant independent from biota.

Great Lakes Environmental Indicators (GLEI)–Development of Indicators for the U.S. Great Lakes Coastal Zone
Gerald Niemi, Center for Water and the Environment, University of MN Natural Resources Research Institute.
cooperative agreement with EPA ORD
plus 27 co-PIs from 10 different academic institutions.
What indicators can measure GL coastal region and well az point to causes of impairment?
ID potential and useful indicators.
Comprehensive exam of relationships between stress and response.
Recommend a suite of indicators.
STAR program.

Timetable 2001, pilot study. 2002-2003–results. 2005 evaluate hypothesis and recommend indicators.
Unbiased sample of sites that will allow us to develop indicators of ecological condition.
Identified segment sheds–762 in US.
Stress data existing prior to sampling. TRI, nitrogen fertilizer use.
Pulled 207 variables from 19 different data layers into 7 categories.

Agriculture
atmospheric deposition
land cover
population
pt. and non-pt. source
shoreline protection soils

Cluster analysis across gradients. Segment sheds with similar stress profiles. Randomization. Within each sampling.
487 places sampled for birds alone.
310 wetland complexes sampled. What is the contributing area to the places sampled? Landscape basis.
Teams co-visited the same sites.
Contaminant, diatoms and water quality, birds and amphibians, wetland vegetation, fish and bugs–all the teams collecting data.
Which are the most important to look at.
Integrated locale polygon all with GPS location.
Contributing area needs to be completed.

Ensure we sampled across the gradients.
Agriculture/chemical–nutrient concentrations.

NASA funded project:
Land cover change detection.

Shoreline morphology–digital elevation modeling. Still in progress.
Quickbird satellite. Detect submerged aquatic vegetation.

Indicator related to a stress-spatial extent of indicator. E.g. landscape and habitat sensitivity of different frog species.

Species-stress relationships.
Upland bird/warblers/agriculture– related to lost forest areas.
Plants–testing relative discriminant ability. Results appeared to be similar to Coastal Wetland Consortium work’s conclusions.

Which indicators are best at detecting change and are economically feasible?
What is the scale of response by species to impacts? Different species have different spatial responses.

Diatoms may become important for identifying metal toxicity.
Contaminant–estrogen to fish.

GLEI integration–variety of issues.
Bringing the indicators together into IBIs.

Successfully implemented large-scale monitoring.
Multiple stress gradients identified.
Linking to sources of stress.
Identified non-natives and stress responses.
Need parallel effort on Canadian side.

CCME (Canadian) Water Quality Index
Scott Painter, Environment Canada, Environmental Conservation Branch Ontario Region
8 years, adopted by CCME.
Tool for simplifying the reporting of water quality data. Designed to translate complex water quality data into an overall integrated score for a site.
Compares dat of a number of parameters, how high above guidelines, takes scores and labels water as “good” etc.

One of 6 natural capital indicators (Canada).
319 sites across Canada data–measured water quality and characterized.

Index: temporal and parameter representativeness. How does the information change?
3-year rolling average of information to compute index recommended.
Recommend seasonal approach when computing index.
How many parameters? 10% change–mis-ranking or identifying dropping out a priority (when there are 10 parameters).
Recommend 10 or more parameters. Include those parameters that are relevant to a particular site.

Sediment quality index:
Data integrated over the area of the site as opposed to over time.
Scores are computed at single sites–using 30 sediment quality parameters (metals, dioxin, PAHs)
See west to east gradients. Western L. ER good to fair, and eastern L. ER excellent. Related to sources of contamination and sediment types.
L. ON lower scores than L. ER. No west to east gradient.
Can compute score for an area or a number of clustered sites.

Questions:
Have you thought about weighting measures in order to understand impact to biology?
Differences between parameters are by guidelines. Some use a sub-index approach.
Thought about magnitude of exceedances? Philosophical argument.

Canadian Biodiversity Index, Outline of Framework and Proof of Concept Testing
Wayne Bond, Environment Canada, National Indicators and Reporting Office
(standing in for Risa Smith)
Based on water quality index.
Purpose–communications tool, for senior managers/policy makers–what is the state of biodiversity?
Goal to capture complexity but also be a non-technical communications tool.
Consistent methods for organizing information and convey information in an easy to understand way.

Followup to 1992 Convention on Biological Diversity. Global requirement to report back on biodiversity loss in 2010.
Recommendation by National Roundtable on Environment and Economy to report on both. Extent of wetlands and forest cover not yet funded but recommended.

Mock-up–healthy, moderately impaired, impaired, and critically impaired at each assessed ecosystem. Broadly representative.
Ecounit–geographic unit that could be mapped and makes ecological sense.
Grasslands, forests, wetlands.
Progress:
framework development completed
proof of concept testing–scoring and aggregation of methodologies
database structure
users manual

framework components:
endpoint–aggregation of ecounit assessments, with common themes:
1. species and genes
2. animal health and plant communities–population, rareness etc.
3. landscape–land use change, connectivity, fragmentation, vulnerabilit, species within a particular unit or outside of it, habitat type vulnerability
4. human influence–eco footprint, phosphorus and nitrogen, sediment flow and availability, harvest rates, etc.

indicators, measured against attainment of a desired future state
method of aggregation within each of the four themes.
State-pressure indicators

desired future state–may have to be done locally.
Aggregation by themes and into a schematic. Don't know whether it will be based on guidelines or will involve weighting. May be that indicator that has lowest score will be focused on. Still being debated. May look at a way of averaging.

Proof of concept testing phase. Across the country and at different scales. National forest inventory may be the first to be tested.
Background documents:
Canadian Biodiversity Index: Framework Document
National Forest Inventory
Canadian Information System for the Environment
Biodiversity Indicators in Use

QUESTIONS:
- Has this been tested yet? Not yet, but BC has put together the testing manual.
- How can you get at desired future condition for the indicators? Work through the proof of concept testing and work in a particular area and identify targets. Work with scientists. Possibly a Delphi process to come up with desired future conditions. May be site-specific questions.

- Desired future outcome seems to be subject to pressure from politicians. Little faith if it’s politically based.

Must have scientific credibility and so they have to have some say in setting targets. Ten years minimum to have a target set so less susceptible to politics.
In MN we have try to go back to pre-settlement, detailed notes.
IBIs for the Consortium–reference sites and conditions will be used to compare with present conditions at similar sites.
Politics–interactions in MI–the agencies are open and trying to get information for use.
Legislative response–they need information before they make decisions. Needs to be timely.
Can be different levels of desired outcomes–scientific, social, etc. To get people to accept your information, you need to have answers for all the themes mentioned. May be different uses identified and each may need a different target or desired endpoint.
Use of index as a communication tool–why? To create change–policies, management practices, programming. Eg.: we could put information to our politicians and re-iterate science.
We use indicators to create changes. If you want to change–it needs to be practical and useable and in context and interpreted by people who are able to interpret.
Reporting on an aggregate scale may be problematic unless you are specific about each theme and use characteristics.
Focused on most stringent use for test purposes but would not advocate aggregating uses.

- Uncertainty: for an individual measure there will be uncertainty and that will increase as we add measures. Was error addressed and how?

(GLEI) Variability is uncertainty and we do look at that.
(CWC) IBI concept is that you have redundancy so they are not independent–it strengthens your assessment. Each metric is only included if you are getting an explanation of variability. Water level cycle for plants–many of the most useful variable were not readily sampled when water levels low.
(WQI) Calculation is a yes/no decision so you get different issues–is your program actually measuring what you need it to measure? Have to look at the science behind the guidelines. Need to look at the time of sampling, etc. as surrogates of human activities. May want to lump different sampling parameters but that increases redundancy to offset uncertainty.
(CBI) Need to come up with science-based rules. We are being conservative in the lumping process. My use indicator that scored lowest.

- Distinguishing natural from human-induced is difficult–how are the projects dealing with it?

Need long term data sets to begin to distinguish.
Upstream-downstream or reference approach taken by some programs. What level of anthropogenic disturbance will we tolerate–typically it’s a reference. Need to establish a benchmark.
Do you have to have a reference for each site? Yes.
Reference conditions are built into the IBI approach and it is regional.

- What kind of regions are we talking about in terms of SOLEC?

It could be basinwide, north/south, etc. If your goal is to protect reference conditions into Lake MI, you need to set it regionally. Consistency across a large scale like the Great Lakes–have to

have buy in to methodologies from all those collecting data and you need comparable methodologies. Now we have much data being collected but not comparable. We’ve done long term sampling–there are geomorphological differences so we are developing strata for different biota to look at differences. Potential strata and sampling within them.
Eco province and section may be possible spatial scale to use.
No one answer because it depends on resource you are trying to protect. Need a bit of all scales.
Natural vs human-induced. Philosophical.